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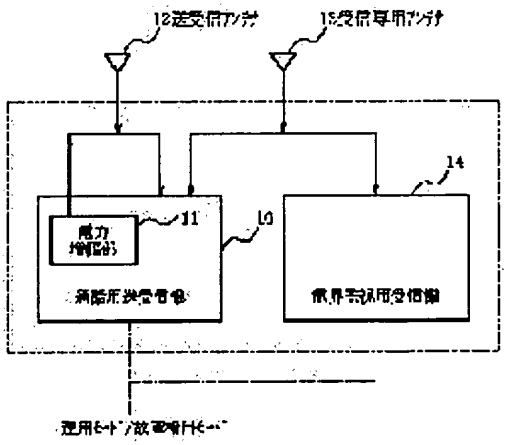
(54) RADIO BASE STATION EQUIPMENT WITH FAULT DETECTION FUNCTION AND MOBILE COMMUNICATION SYSTEM USING THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To detect a fault of a radio base station without provision for a test exclusive terminal and a dummy test function.

SOLUTION: Each radio base station equipment is provided with a speech use transmitter-receiver 10 that makes inter-communication with a mobile terminal via a transmission reception antenna 12 and a reception exclusive antenna 13 through incoming and outgoing radio waves with a prescribed frequency and with an electric field monitor receiver 14 that monitors a state of the incoming and outgoing radio waves via the reception exclusive antenna 13. Then back-off of a power amplifier section 11 of the speech use transmitter-receiver 10 is released to check a reception function of the speech use transmitter- receiver 10 itself by outputting an outgoing radio wave with a prescribed transmission power or over, the electric field monitor receiver 14 of an adjacent radio base station equipment receives the transmission power to check a transmission function of the speech use transmitter-receiver 10, and the electric field monitor receiver 14 receives an outgoing radio wave from an adjacent radio base station equipment to detect all faults in the radio base station equipment.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the mobile communication system which consists of base transceiver station equipment which performs fault detection of self-equipment, and these base transceiver station equipment by having a receiver for an electric-field monitor and radiocommunicating among other base transceiver station equipments about the mobile communication system which used base transceiver station equipment with a fault detection function, and it.
[0002]
[Description of the Prior Art] In order to perform fault detection of that base transceiver station equipment, the conventional mobile communication system prepares the migration terminal only for trials of working, and is examining by a maintenance man moving this migration terminal for a trial near the examined base transceiver station equipment.
[0003] Moreover, the base transceiver station equipment only for trials connected to the exchange or the private branch exchange (PBX) like the general base transceiver station may be installed near each base transceiver station equipment, and it may examine by starting this base transceiver station equipment for a trial by remote control.
[0004] Furthermore, in addition to the configuration which performs general call processing to a part or all base-transceiver-station equipments, the false trial terminal section which performs the same processing as a migration terminal at the time of setting out in the mode for a trial prepares, and it may examine by making it radiocommunicate between the base-transceiver-station equipment which has the base-transceiver-station equipment and the pseudo terminal processing section of a test objective (refer to JP,7-298345,A (the base station test method and the base station of mobile communication system)).
[0005]
[Problem(s) to be Solved by the Invention] With the conventional base transceiver station equipment mentioned above, when it is necessary to move the dedicated terminal for a trial to near the examined base transceiver station equipment and examines much base transceiver station equipments whenever a maintenance man examines in using the migration terminal only for trials for performing the fault detection, there is a fault that the manday needed becomes very large.
[0006] Moreover, when giving the base transceiver station only for trials to each base transceiver station equipment and performing it, remote control becomes possible by the exchange and the technical problem of the test method by the migration terminal only for trials does not exist. However, there is a fault that lowering and the great cost of the facility effectiveness of the whole system start, by having base transceiver station equipment only for trials.
[0007] Moreover, although the two above-mentioned technical problems do not exist when preparing the false trial terminal section which performs the same processing as a migration terminal to a part or all base transceiver station equipments in addition to the

configuration which performs general call processing, there is a fault of barring the miniaturization of base transceiver station equipment, low-pricing, and low-power-ization by having the pseudo terminal processing section.
[0008] The object of this invention is to offer the base transceiver station equipment with a fault detection function which enabled detection of fault detection autonomously, and the mobile communication system using it.
[0009]
[Means for Solving the Problem] The base transceiver station equipment with a fault detection function of this invention In the base transceiver station equipment which has the wireless circuit zone which communicates by the mobile terminal and wireless, is connected to the exchange through a cable with other base transceiver station equipments, and constitutes mobile communication system The transceiver antenna which transmits and receives an electric wave, and the reception only antenna which receives an electric wave, Going up of predetermined frequency and the transmitter-receiver for a call for carrying out a mutual call, getting down and performing said mobile terminal and receiving diversity through said transceiver antenna and a reception only antenna through radio, It has going up of said predetermined frequency and the receiver for an electric-field monitor which gets down and supervises the condition of an electric wave through said reception only antenna. It has the configuration which makes fault detection of self-equipment possible by radiocommunicating between base transceiver station equipment besides the above using said transmitter-receiver for a call, and the receiver for an electric-field monitor.
[0010] Moreover, in the above-mentioned configuration, said transmitter-receiver for a call gets down, and it has the controllable power amplification section for the transmitted power of an electric wave in arbitration. The electric-wave interference to the base transceiver station equipment which adjoins by getting down with the predetermined transmitted power which talks over the telephone between said mobile terminals, and which usually gave the back off to the transmitted power of said power amplification section at the time of employment, and was reduced from maximum, and outputting an electric wave is prevented. At the time of the fault detection which performs fault detection of self-equipment While enabling reception of the electric wave concerned by said adjoining base transceiver station equipment and enabling the check of the transmitting function and reception function of the transmitter-receiver for a self-call by canceling the back off of said power amplification section, getting down with the transmitted power more than said predetermined transmitted power, and outputting an electric wave It can consider as the configuration which enables the check of the reception function of the receiver for a self-electric-field monitor by [which get down and receives an electric wave] having been outputted with the transmitted power more than said predetermined transmitted power from said adjoining base transceiver station equipment.
[0011] The mobile communication system of this invention has the configuration which makes possible fault detection of each base transceiver station equipment by radiocommunicating the base transceiver station equipment with a fault detection function of the above-mentioned configuration two or more preparations and between [adjoining] base transceiver station equipment.
[0012] Moreover, in the mobile communication system of the above-mentioned

configuration, the transmitter-receiver for a call of each of said base transceiver station equipment gets down, and it has the controllable power amplification section for the transmitted power of an electric wave in arbitration. The electric-wave interference between base transceiver station equipment which adjoins by said each base transceiver station equipment's getting down with the predetermined transmitted power which talks over the telephone between said mobile terminals, and which usually gave the back off to the transmitted power of said power amplification section of each base transceiver station equipment at the time of employment, and was reduced from maximum, and outputting an electric wave is prevented. At the time of the fault detection which performs fault detection of each of said base transceiver station equipment By canceling the back off of said power amplification section of the base transceiver station equipment for fault detection, getting down with the transmitted power more than said predetermined transmitted power, and outputting an electric wave While enabling reception of the electric wave concerned by said receiver for an electric-field monitor of said adjoining base transceiver station equipment and enabling the check of the transmitting function and reception function of the transmitter-receiver for a call of base transceiver station equipment for [said] fault detection It can consider as the configuration which enables the check of the reception function of said receiver for an electric-field monitor of the base transceiver station equipment for [said] fault detection by canceling the back off of said power amplification section of said adjoining base transceiver station equipment, getting down with the transmitted power more than said predetermined transmitted power, and outputting an electric wave.

[0013] As explained above, the base transceiver station equipment of this invention Go up, a transceiver antenna and a receiving antenna, and a predetermined frequency get down, and it goes via said transceiver antenna and a reception only antenna through radio. Provide the transmitter-receiver for a call which carries out a mutual call with a mobile terminal, and the receiver for an electric-field monitor which supervises the rise-and-fall electric-wave condition of a predetermined frequency via a reception only antenna, and the back off of the power amplification section of the transmitter-receiver for a call is canceled. It gets down and an electric wave is outputted with the transmitted power more than predetermined. The receiver of a transmitter-receiver own [for a call] Moreover, the receiver for an electric-field monitor of adjoining base transceiver station equipment is made to receive, it gets down from adjoining base transceiver station equipment from the transmitter of the transmitter-receiver for a call further, the receiver for an electric-field monitor receives an electric wave, and all fault detection in base transceiver station equipment is performed. Thus, according to this invention, fault detection of each base transceiver station equipment can be carried out by enabling connection (transmission and reception) of between [which mobile communication system adjoins] base transceiver station equipment through radiocommunication.

[0014]

[Embodiment of the Invention] The gestalt of operation of this invention is explained with reference to a drawing.

[0015] Drawing 1 is drawing showing the wireless circuit zone configuration at the time of the fault detection of the base transceiver station equipment of the mobile communication system which is the example of 1 operation gestalt of this invention. Drawing 2 is drawing showing the configuration of the base transceiver station

equipment of the example of 1 operation gestalt of this invention, and shows only the part in connection with this invention. Drawing 3 is drawing showing the wireless circuit zone configuration at the time of employment of the base transceiver station equipment of the mobile communication system of this example.

[0016] As shown in drawing 1 and drawing 3 , the mobile communication system of this example It has a wireless circuit zone (6-1, 6-2, --, 6-n and 7-1, 7-2, --, 7-n), respectively. It has two or more mobile terminals 5-1, 5-2, --, two or more base transceiver station equipments 1-1 that perform communication link with 5-n, and control, 1-2, --, 1-n and the exchange (private branch exchange: PBX) 4 which performs communication link and control through a cable to these base transceiver station equipment through wireless. In addition, since equipment required as usual mobile communication system is realizable with a well-known suitable technique, detail explanation is omitted.

[0017] Next, the transceiver antenna 12 and the reception only antenna 13 for each base transceiver station equipment 1-1 - 1-n to transmit and receive an electric-wave signal, respectively, as shown in drawing 2 , Go up, the predetermined frequency corresponding to a call CH (channel) assignment signal gets down, and it goes via the transceiver antenna 12 and the reception only antenna 13 through radio. The transmitter-receiver 10 for a call which consists of the transmitter and receiver (not shown [both]) which carry out a mutual call with the mobile terminal 5-1 - 5-n while using a receiving diversity function, Going up in [the reception only antenna 13 to] a wireless circuit zone, Although it is not illustrating with the receiver 14 for an electric-field monitor which the base transceiver station equipment of a system gets down, and supervises an electric wave except that it gets down, an electric wave is inputted and it is applying on the frequency of the uphill electric-wave condition of the mobile terminal 5-1 of a predetermined frequency - 5-n corresponding to an electric-field monitor CH assignment signal and adjoining base station equipment, or near It has the interface section for connecting with the control section and the exchange 4 which control the whole through a wire circuit. Moreover, the power amplification section 11 which can be changed into arbitration is included for the transmitted power of the electric-wave signal through the transceiver antenna 12 in the transmitter of the transmitter-receiver 10 for a call by the command from a control section. An example of the input-output behavioral characteristics of the power amplification section 11 is shown in drawing 4 .

[0018] Next, actuation is explained. The example of 1 operation gestalt applied to the digital mobile communication system which has adopted the pai-fourth-Differential-QPSK method as a TDMA-FDD method and a modulation technique by making this invention into an access method hereafter is explained in full detail, referring to a drawing.

[0019] the digital mobile communication system of this example connects by the dedicated line, an ISDN circuit, etc. between each ** of the exchange (PBX) 4, two or more base transceiver station equipments 1-1 - 1-n -- having -- two or more base transceiver station equipments 1-1 from the one exchange 4 - 1-n -- it is alike, respectively, and it receives and communication link and control are performed. Furthermore, each base transceiver station equipment 1-1 - 1-n are the protocols decided beforehand, and perform communication link and control through two or more mobile terminals 5-1 - 5-n, and wireless.

[0020] As a circuit design of the wireless circuit zone 6-1 at the time of usual

employment of such digital mobile communication system - 6-n, when carrying out the covering ledge of the service area radius Am, the wireless specification of base transceiver station equipment 1-1 - 1-n, and the mobile terminal 5-1 - 5-n is determined by going up / gain of the antenna getting down, transmitted power, receiving sensibility, and the transmission-line propagation loss. for example, in covering a service area in the radius of A= 200m It is related with the transmitted power and receiving sensibility which are a part of wireless specification. Base transceiver station equipment 1-1 - 1-n, and the mobile terminal 5-1 - 5-n It is set to 200mW / 100mW, and sensibility 0dBmuV/3dBmuV. Between base transceiver station equipment 1-1 - 1-n, and the mobile terminal 5-1 - 5-n Predetermined UP/DOWN A system level diamond is built so that the received electric-field level in fixed within the limits may be inputted into LINK 1-1, i.e., base transceiver station equipment, - 1-n, and the mobile terminal 5-1 - 5-n, and two-way communication of voice and a non-voice is made possible.

[0021] Moreover, as the employment circuit frequency setting approach, the scanning actuation ordered from the exchange 4 at the time of starting of base transceiver station equipment 1-1 - 1-n was started, the frequency condition in a zone (the value of a frequency, frequency occurrence frequency, level, circuit quality) was detected in the receiver 14 for an electric-field monitor in base transceiver station equipment 1-1 - 1-n, and the information result is reported to the exchange 4. Here, the transmitter-receiver 10 for a call and the receiver 14 for an electric-field monitor operate independently in time-axis mutually.

[0022] An employment frequency is dynamically assigned so that it may be in the condition that the circuit quality with which the employment frequency of each base transceiver station equipment 1-1 - 1-n does not have electric-wave interference, and can be satisfied of a predetermined D/U ratio is higher than the frequency status-report result of all the base transceiver station equipments 1-1 by which cable connection is made by the carrier beam exchange 4 in the report - 1-n. That is, the circuit frequency (F2) which detached the circuit frequency (F1) of a certain mobile terminal 5-1 and the frequency more than deltaf which does not receive electric-wave interference is assigned to other mobile terminals 5-2.

[0023] In the employment condition (operational mode) of such the wireless circuit zone 6-1 - 6-n, when base transceiver station equipment 1-1 - 1-n, and the mobile terminal 5-1 - 5-n are communicating, in order to maintain the orthogonality of a pai-fourth-Differential-QPSK modulation, it applies by the output power (XmW=200mW) which took the 10dB back off so that the linearity of the power amplification section 11 in the transmitter-receiver 10 for a call might be secured. That is, the bias value of the power amplification section 11 which does not degrade the circuit quality from which it gets down is set up.

[0024] Moreover, in order to perform each base transceiver station equipment 1-1 - 1-n to two or more mobile terminals 5-1 - 5-n, and transceiver coincidence with a natural thing, the transceiver filter with an isolation required in order to oppress the receiving band noise at the time of the transmission ON of the transmitter-receiver 10 for a call was provided, and the thermal noise value which does not degrade receiving sensibility, for example, -5dBmuV, is secured. In addition, since the power amplification section 11 of this transmitter-receiver 10 for a call is linear amplifier, if 1dB compression level (P1 dB=YmW=2000mW) raises an input level, the output level also goes up it by fixed gain

proportionally.
[0025] Next, when performing fault detection of base transceiver station equipment 1-1 - 1-n (fault detection mode), the following commands are given to a time zone with little traffic from the exchange 4 one by one to each base transceiver station equipment 1-1 - 1-n, for example. The base transceiver station equipment 1-1 for [which exists first] fault detection is made to set frequency assignment of the transmitter-receiver 10 for a call to F1, and is made to also cancel the 10dB back off of the power amplification section 11 further. At this time, it becomes the wireless circuit zone 7-1 which the output power of base transceiver station equipment 1-1 is set to 200mW, for example, covers the radius of 500m, and ready-for-receiving ability marginal level can be supplied now to adjoining base transceiver station equipment 1-2 (condition of drawing 1). simultaneously, from the exchange 4, frequency assignment of the receiver 14 for an electric-field monitor of the adjoining base transceiver station equipment 1-2 can be set to F1, and it can receive -- a condition .
[0026] It gets down from a fault detection mode signal (for example, a binary code, 11001100 ...), a pai-fourth-Differential-QPSK modulation is carried out through radio (F1), and it is made to emanate from the transceiver antenna 12 from the exchange 4 by 2000mW of output power to base transceiver station equipment 1-1 as the 1st actuation of the fault detection of base transceiver station equipment 1-1 made into the fault detection object in this condition. It is received by the reception only antenna 13 of the base transceiver station equipment 1-2 which declines by the space propagation loss corresponding to [get down and] a frequency, or an installation environment and distance in an electric wave (F1), and is installed adjacently. With the receiver 14 for an electric-field monitor, the received electric wave (F1) restores to a modulating signal, and judges whether it is a fault detection mode signal. When a recovery signal is in agreement with fault detection mode (11001100 ...), it is recognized as the transmitter of the transmitter-receiver 10 for a call of base transceiver station equipment 1-1 being normal. On the other hand, it becomes a recovery signal (101010 ...), and when an inequality is carried out, or when an electric wave is non-receipt electric-field information, the transmitters of the transmitter-receiver 10 for a call are recognized to be abnormalities. Here, the base transceiver station equipment 1-1 for fault detection gets down, and fault detection check actuation of the transmitting function of an electric wave, i.e., the transmitting function of the transmitter-receiver 10 for a call, is completed.
[0027] Next, as the 2nd, the output UP for the back off of the transmitter-receiver 10 for a call means that receiving band noise also increases in the 1st actuation and coincidence, and performs fault detection of a reception function to them using this. For example, receiving band noise before the back off - When back-off discharge is set to +5dBmuV of 10dBUP(s), the electric-field detection of it is attained with the receiver of the transmitter-receiver 10 for a call and that it was 5dBmicrovolt reports that it is +5dBmuV, it is recognized to be normal. On the other hand, when the electric-field detection value at the time of a non-signal [like -5dBmuV] whose electric-field detection report value is is reported, it is recognized as unusual. Here, fault detection check actuation of the reception function of the going-up electric wave of the base transceiver station equipment 1-1 for fault detection, i.e., the reception function of the transmitter-receiver 10 for a call, is completed.
[0028] Next, as the 3rd, transmission/receive mode of base transceiver station equipment

1-1 and base transceiver station equipment 1-2 are reversed mutually. That is, it gets down from base transceiver station equipment 1-2, and the back off of the power amplification section 11 of the transmitter-receiver 10 for a call is canceled, and an electric wave (F1) is made to set frequency assignment of the receiver 14 for an electric-field monitor of base transceiver station equipment 1-1 to F1, to consider as a receivable condition, and to emit from the exchange 4. Then, it gets down, and a pai-fourth-Differential-QPSK modulation is carried out, and a fault detection mode signal (11001100 ...) is made to emit from the transceiver antenna 12 by 2000mW of output power through radio (F1) to the exchange 4 to base transceiver station equipment 1-2. It is received by the reception only antenna 13 of the base transceiver station equipment 1-1 which decreases an electric wave (F1) by the space propagation loss by getting down, and is installed adjacently. With the receiver 14 for an electric-field monitor, the received electric wave (F1) restores to a modulating signal, and judges it in a fault detection mode signal. When a recovery signal is in agreement with fault detection mode (11001100 ...), it is recognized as the reception function of the receiver 14 for an electric-field monitor of base transceiver station equipment 1-1 being normal. On the other hand, it becomes a recovery signal (101010 ...), and when an inequality is carried out, or when an electric wave is non-receipt electric-field information, the reception functions of the receiver 14 for an electric-field monitor are recognized to be abnormalities. Here, the base transceiver station equipment 1-1 for fault detection gets down, and fault detection check actuation of the reception function of an electric wave, i.e., the reception function of the receiver 14 for an electric-field monitor, is completed.

[0029] As for the base transceiver station equipment 1-1 for fault detection, in the case of abnormalities, the whole of normality and at least the 3rd one actuation [the 1st -] mentioned above is judged that base transceiver station equipment 1-1 is unusual when normal.

[0030] similarly, by other base transceiver station equipment 1- (m-1) and its adjoining base transceiver station equipment 1-m, transmission/receive mode, and base transceiver station equipment 1-m becomes reception/transmitting mode, and base transceiver station equipment 1- (m-1) repeats above-mentioned fault detection actuation -- (-- here -- 1 -- < -- fault detection of m<n), and all the base transceiver station equipments 1-1 in a system - 1-n can be performed. A series of above-mentioned flow drawings of operation are shown in drawing 5 .

[0031]

[Effect of the Invention] As having explained above, this invention has the advantage that can gather the facility effectiveness in the whole system, or it can contribute also to the miniaturization of base transceiver station equipment, and low-pricing, without having a migration terminal for a trial independently, or having the false trial terminal section in base transceiver station equipment, since the receiver for an electric field monitor of adjoining base transceiver station equipment receives and the fault detection of base transceiver station equipment can judge using the transmitted electric wave of the transmitter-receiver for a call in base transceiver station equipment. Furthermore, since it can distinguish whether the receiver for an electric-field monitor is out of order in whether the transmitter-receiver for a call is out of order with autonomous automatic control from the exchange, there is also an advantage that maintainability improves.

CLAIMS

[Claim(s)]

[Claim 1] In the base transceiver station equipment which has the wireless circuit zone which communicates by the mobile terminal and wireless, is connected to the exchange through a cable with other base transceiver station equipments, and constitutes mobile communication system The transceiver antenna which transmits and receives an electric wave, and the reception only antenna which receives an electric wave, Going up of predetermined frequency and the transmitter-receiver for a call for carrying out a mutual call, getting down and performing said mobile terminal and receiving diversity through said transceiver antenna and a reception only antenna through radio, It has going up of said predetermined frequency and the receiver for an electric-field monitor which gets down and supervises the condition of an electric wave through said reception only antenna. said transmitter-receiver for a call, and the receiver for an electric-field monitor -- using -- said -- others -- the base transceiver station equipment with a fault detection function characterized by making fault detection of self-equipment possible by radiocommunicating between base transceiver station equipment.

[Claim 2] Said transmitter-receiver for a call gets down, and it has the controllable power amplification section for the transmitted power of an electric wave in arbitration. The electric-wave interference to the base transceiver station equipment which adjoins by getting down with the predetermined transmitted power which talks over the telephone between said mobile terminals, and which usually gave the back off to the transmitted power of said power amplification section at the time of employment, and was reduced from maximum, and outputting an electric wave is prevented. At the time of the fault detection which performs fault detection of self-equipment While enabling reception of the electric wave concerned by said adjoining base transceiver station equipment and enabling the check of the transmitting function and reception function of the transmitter-receiver for a self-call by canceling the back off of said power amplification section, getting down with the transmitted power more than said predetermined transmitted power, and outputting an electric wave Base transceiver station equipment with a fault detection function according to claim 1 characterized by enabling the check of the reception function of the receiver for a self-electric-field monitor by [which get down and receives an electric wave] having been outputted with the transmitted power more than said predetermined transmitted power from said adjoining base transceiver station equipment.

[Claim 3] Mobile communication system characterized by making possible fault detection of each base transceiver station equipment by radiocommunicating base transceiver station equipment with a fault detection function according to claim 1 two or more preparations and between [adjoining] base transceiver station equipment.

[Claim 4] The transmitter-receiver for a call of each of said base transceiver station equipment gets down, and it has the controllable power amplification section for the transmitted power of an electric wave in arbitration. The electric-wave interference between base transceiver station equipment which adjoins by said each base transceiver station equipment's getting down with the predetermined transmitted power which talks over the telephone between said mobile terminals, and which usually gave the back off to

the transmitted power of said power amplification section of each base transceiver station equipment at the time of employment, and was reduced from maximum, and outputting an electric wave is prevented. At the time of the fault detection which performs fault detection of each of said base transceiver station equipment By canceling the back off of said power amplification section of the base transceiver station equipment for fault detection, getting down with the transmitted power more than said predetermined transmitted power, and outputting an electric wave While enabling reception of the electric wave concerned by said receiver for an electric-field monitor of said adjoining base transceiver station equipment and enabling the check of the transmitting function and reception function of the transmitter-receiver for a call of base transceiver station equipment for [said] fault detection By canceling the back off of said power amplification section of said adjoining base transceiver station equipment, getting down with the transmitted power more than said predetermined transmitted power, and outputting an electric wave Mobile communication system according to claim 3 characterized by enabling the check of the reception function of said receiver for an electric-field monitor of the base transceiver station equipment for [said] fault detection.

[Translation done.]